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United States Patent [19][11] Patent Number: **5,081,560** ✓**Donnerstag**[45] Date of Patent: **Jan. 14, 1992**[54] **LOAD CENTER ENCLOSURE**[75] Inventor: **Leonard Donnerstag, Atlanta, Ga.**[73] Assignee: **Siemens Energy & Automation, Inc., Alpharetta, Ga.**[21] Appl. No.: **589,233**[22] Filed: **Sep. 27, 1990**[51] Int. Cl.³ **H02B 1/04**[52] U.S. Cl. **361/358; 361/346; 361/355; 361/361**[58] Field of Search **361/341, 346, 353-363, 361/376, 391, 415; 211/41**[56] **References Cited****U.S. PATENT DOCUMENTS**

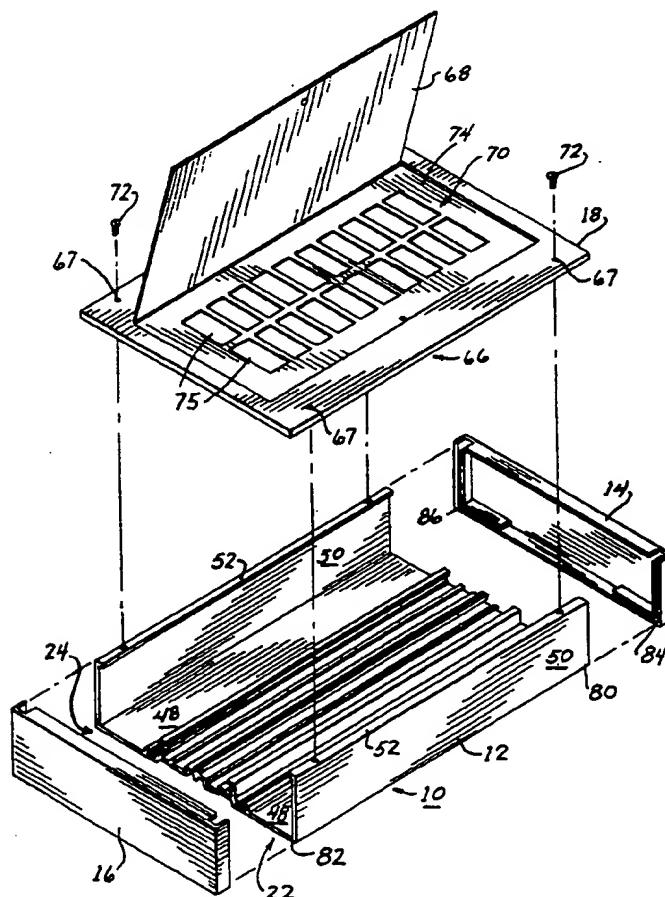
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[57] **ABSTRACT**

A load center enclosure according to the invention has a unitary plastic frame of uniform cross-section, including a central base pan portion having projections, slots, and the like suitable for mounting bus bars, circuit breakers and neutral bars thereon. The frame also has a rear wall and a pair of opposed side walls which form part of the enclosure, the base pan portion serving as part of the rear wall of the enclosure. A pair of covers are secured to opposite ends of said frame to form top and bottom walls of said enclosure. A door assembly may then be mounted on the front of the enclosure. Such a load center enclosure utilizes an extrudable plastic frame as both a major component of the enclosure and as a base pan for mounting the current-carrying electrical components.

18 Claims, 2 Drawing Sheets

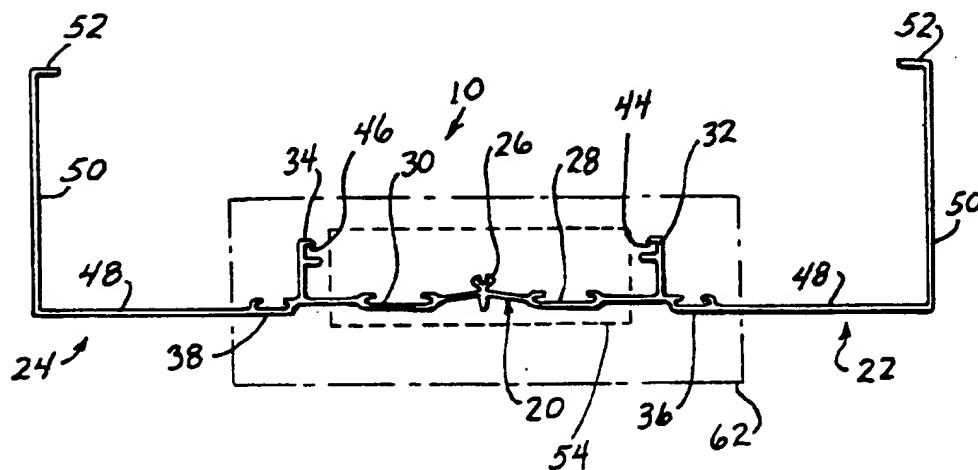
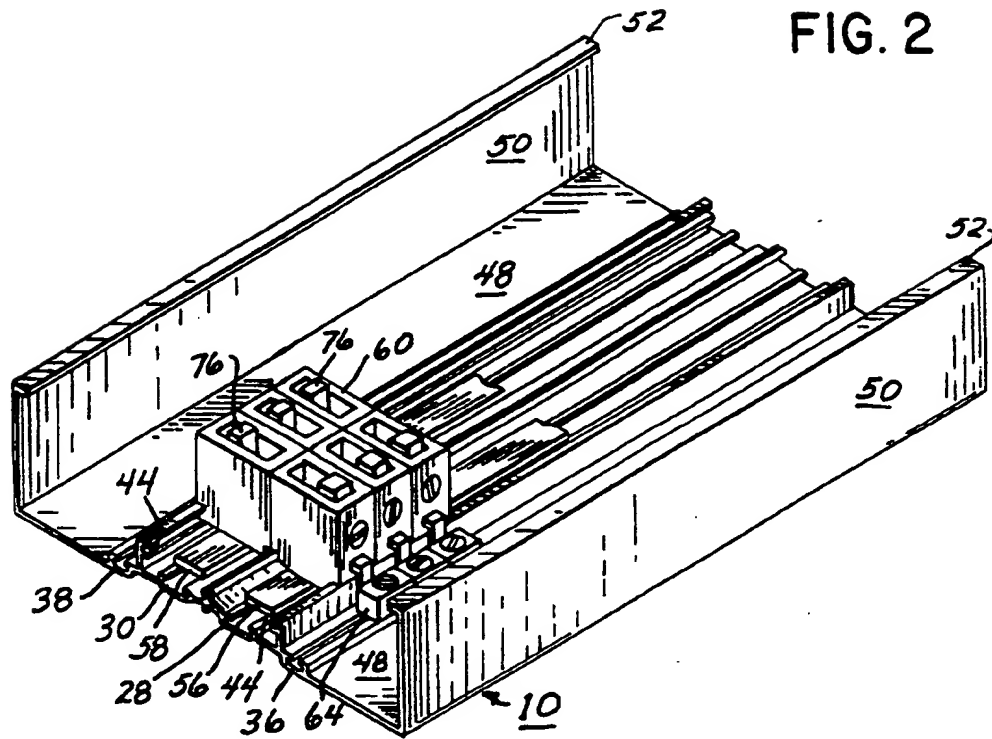


FIG. 3

LOAD CENTER ENCLOSURE

TECHNICAL FIELD

The present invention relates generally to devices for the distribution of electrical power and, more particularly, to load center enclosures for home and light-industrial applications.

BACKGROUND OF THE INVENTION

Typical load centers include a metal enclosure having an open face opposite its bottom, wherein an insulative base pan is inserted through the open face and fastened to the bottom. U.S. Pat. No. 4,536,823, issued on Aug. 20, 1985 to Ingram, et al., discloses an extruded insulative base pan mountable within a load center enclosure. FIG. 2 of U.S. Pat. No. 4,536,823 illustrates an insulative base pan 14 within an enclosure (box) 12. This arrangement provides a satisfactory assembly for supporting the bus bars, neutral bars and circuit breakers within the metallic enclosure while also electrically insulating these components from the enclosure. The enclosure, being fabricated from a material such as sheet metal, provides a means of ensuring that any fire which may occur within the enclosure is inhibited from spreading to the exterior of the enclosure.

While this type of load center assembly functions adequately, the cost of manufacturing this assembly is relatively high. This can be attributed to the cost of using sheet metal to form the enclosure, the process of forming the sheet metal enclosure, the process of fabricating the separate base pan, and the labor involved in fastening the base pan within the enclosure. Thus, there remains the need for a load center configuration of a design which can reduce one or more of the material cost, the number of steps required to fabricate the load center, and the number of components from which the load center is assembled.

SUMMARY OF THE INVENTION

A load center enclosure according to the invention has a unitary plastic frame of uniform cross-section, including a central base pan portion having projections, slots, and the like suitable for mounting bus bars, circuit breakers and neutral bars thereon. The frame also has a rear wall and a pair of opposed side walls which form part of the enclosure, the base pan portion serving as part of the rear wall of the enclosure. A pair of covers are secured to opposite ends of said frame to form top and bottom walls of said enclosure. A door assembly may then be mounted on the front of the enclosure to any convenient part of the frame, such as the side walls, or preferably a pair of flanges which extend inwardly from the side walls. The invention further provides an extrudable plastic base pan/frame combination useful in such an enclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred exemplary embodiment of the invention will be described in conjunction with the appended drawings, wherein like numerals denote like elements, and:

FIG. 1 is an exploded perspective view of a load center to the invention;

FIG. 2 is an end view of the base pan shown in FIG. 1; and

FIG. 3 is a perspective view of a load center according to the invention assembled using the base pan of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EXEMPLARY EMBODIMENT

Referring to FIG. 1, a rectangular load center enclosure 10 in accordance with the invention comprises a central unitary frame 12, a pair of top and bottom end covers 14, 16 secured to opposite ends of frame 12, and a door assembly 18 mounted on the front of frame 12 to complete the enclosure. Frame 12 has a uniform cross-sectional shape along its length, rendering it suitable for manufacture by conventional extrusion methods.

Referring to FIG. 2, frame 12 comprises a central, generally flat base pan portion 20 (within the broken lines 62 in FIG. 2) and a pair of opposed, generally L-shaped side wrapper portions 22, 24 extending from opposite sides of base pan 20. The shape of portion 20 is preferably the same as that of the base pan illustrated in FIG. 3 of U.S. Pat. No. 4,536,823, issued on Aug. 20, 1985, the entire contents of which are incorporated herein by reference. More specifically, portion 20 includes a central insulative rail 26 which is generally Y-shaped in cross-section, a pair of symmetrical lengthwise slots 28 and 30 located on opposite sides of rail 26, a pair of opposed, symmetrical, inwardly extending brackets 32 and 34 located outwardly of slots 28, 30, and a second pair of symmetrical slots 36 and 38 located outwardly of brackets 32 and 34 respectively.

Side wrapper portions 22 and 24 each include a rear wall portion 48, a side wall portion 50 and an inwardly directed flange 52. Rear walls 48 in combination with base pan portion 20 form the rear wall of enclosure 10; no separate base pan-enclosure assembly is required as in the prior art, allowing easier manufacture. Side walls 50 extend from rear walls 48 at right angles and terminate at flanges 52. Flanges 52 extend inwardly a short distance at right angles from walls 50 and are parallel to rear walls 50, such that frame 12 is generally U-shaped in cross-section.

Frame 12 is preferably produced by extruding an electrically non-conductive plastic into the illustrated uniform cross-sectional shape. Suitable plastics include thermoplastic resins stable to about 265° C., such as polyphenylene oxide or acrylonitrile-butadiene-styrene (ABS) resins. One such plastic is Noryl 265 manufactured by General Electric, which combines good mechanical strength, heat resistance, and electrical properties which are maintained at high temperatures.

Frame 12 is fabricated by cutting the extruded plastic member widthwise to a predetermined length. The predetermined length determines the length of the load center and, accordingly, the maximum number of circuit breakers which can ultimately be housed within the load center. Extruded frame 12 is a unitary structure including the base pan, back and side walls for the load center enclosure 10, and a partial front wall thereof.

Referring to FIG. 3, load carrying bus bars 56 and 58 are disposed in and engaged with slots 28 and 30, respectively. Slots 36 and 38 similarly receive neutral bars 64. Circuit breakers 60 are mounted in grooves 44 and 46 of brackets 32 and 34, respectively, in contact with bus bars 56, 58 and neutral bars 64 in a manner well known in the art.

Referring again to FIG. 1, load center door assembly 18 comprises a rectangular door frame 66 having a central access opening 70, and a door 68 mounted with

hinges (not shown) to frame 66. Frame 66 has holes 67 near its corners and is fastened to flanges 52 by suitable means, such as screws 72, rivets, or other similar fasteners. Frame 66 also includes a recessed circuit breaker cover 74 disposed in opening 70. Cover 74 includes two substantially parallel rows of openings 75 through which switch handles 76 of each circuit breaker 60 are accessible.

End covers 14 and 16 are fastened to opposite ends 80 and 82 of frame 12, respectively. Covers 14 and 16 each include a pair of spaced, L-shaped, double-walled edge portions 84 and 86 for engaging the opposite ends of side wrapper portions 22 and 24, respectively. Once in position, covers 14, 16 can either be ultrasonically welded to frame 12, or fastened to frame 12 by any other suitable means, such as by fasteners or with an adhesive. For welding purposes, covers 14, 16 are preferably injection-molded from a heat-resistant plastic compatible with the plastic of wrapper portions 22, 24, such as ABS or the equivalent.

According to a further embodiment of the invention, frame 12 is produced by coextrusion using known coextrusion methods from at least two different plastics having different properties. Base pan portion 20 must be able to withstand heat generated by the load center, and thus should not melt or distort at temperatures likely to be generated in the enclosure at peak loads. On the other hand, side wrapper portions 22, 24 are not in direct contact with current-carrying parts and can be made of a resin having a lower thermal stability. Both resins should be extrudable at the same temperature and be sufficiently compatible to form a strong bond along the sides of base pan portion 20. The resins should also have high electrical resistance, mechanical strength sufficient for application as an enclosure, and should preferably be self-extinguishing when exposed to flame.

For these purposes base pan portion 20 can be made of a first thermoplastic resin stable up to 265° F., such as a polyphenylene oxide. Side wrapper portions 22, 24 are each made of a coextruded second resin, such as ABS, having lower thermal stability than the first resin, e.g., up to about 200°-225° F. A combination of Noryl 265 base pan portion 20 and an ABS resin side wrapper portions 22 and 24 is preferred.

Referring again to FIG. 2, if frame 12 is coextruded using two electrically non-conductive plastics, at least the portion of frame 12 falling within the dashed lines 54, including slots 28, 30 and rail 26, should be manufactured from a plastic which is stable to 265° F. to avoid degradation as a result of heating due to current flow in bus bars 56, 58. Depending upon the requirements of the load center incorporating frame 12, the portion of frame 12 between lines 54 and 62, including brackets 32, 34 and slots 36, 38, can be made of the first plastic having high thermal stability, the second plastic having less thermal stability, or a third plastic with an intermediate thermal stability, i.e., less than 265° F. but greater than 225° F.

It will be understood that the above description of the preferred exemplary embodiment of the invention, and that the invention is not limited to the specific forms shown. For example, covers 14, 16 and door assembly 18 may be manufactured from any material which meets the applicable codes and standards, such as metal. Additionally, the configuration of the slots and engagement portions may be modified as required by the particular bus bars, neutral bars and circuit breakers used within the load center. Various other substitutions, modifica-

tions, changes, and omissions may be made in the design and arrangement of the elements without departing from the spirit of the invention as expressed in the appended claims.

I claim:

1. A load center enclosure, comprising:
 - a unitary plastic frame of uniform cross-section along its length including a central base pan portion having means for mounting bus bars, circuit breakers and neutral bars thereon, a rear wall, and a pair of opposed side walls;
 - a pair of covers secured to opposite ends of said frame to form top and bottom walls of said enclosure;
 - a door assembly; and
 - means for securing said door assembly to said frame to from the front of said enclosure.
2. The enclosure of claim 1, wherein said frame has a pair of opposed, inwardly directed flanges at the ends of said side walls remote from said rear wall, and said door assembly is mounted on said flanges of said frame.
3. The enclosure of claim 2, wherein said flanges have holes therein, and said securing means comprises a plurality of fasteners, wherein each fastener is received by a respective hole.
4. The enclosure of claim 3, wherein said door assembly comprises a door frame having a central access opening, a door configured to cover said access opening when closed, and hinge means for mounting said door to said door frame.
5. The enclosure of claim 1, wherein said base pan portion includes, on an inner face thereof:
 - a central insulative rail;
 - a first pair of slots on opposite sides of said rail for receiving bus bars;
 - a pair of brackets on opposite sides of said rail wherein each bracket includes a slot for mounting circuit breakers; and
 - a second pair of slots on opposite sides of said brackets outwardly thereof for receiving neutral bars.
6. The enclosure of claim 5, wherein said side walls are spaced from said second pair of slots by said rear wall.
7. The enclosure of claim 6, wherein said side walls extend substantially perpendicularly from said rear wall.
8. The enclosure of claim 1, wherein said covers are made of plastic and are welded to opposite ends of said frame.
9. A generally U-shaped, unitary frame of uniform cross-section made of a heat-resistant, non-electrically conductive plastic, comprising a central base pan portion having means for mounting bus bar, circuit breakers and neutral bars thereon, a rear wall, and a pair of opposed side walls extending from opposite sides of said rear wall, wherein said base pan portion includes, on an inner face thereof:
 - a central insulative rail;
 - a first pair of slots disposed on opposite sides of said rail for receiving bus bars;
 - a pair of brackets on opposite sides of said rail wherein each bracket includes a slot for mounting circuit breakers; and
 - a second pair of slots on opposite sides of said brackets outwardly thereof for receiving neutral bars.
10. The frame of claim 9, wherein said side walls are spaced from said second pair of slots by said rear wall.

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11. The frame of claim 10, wherein said side walls extend substantially perpendicularly from said rear wall.

12. A generally U-shaped, unitary frame of uniform cross-section along its length made of a heat-resistant, non-electrically conductive plastic, comprising a central base pan portion having means for mounting bus bars, circuit breakers and neutral bars thereon, a rear wall, and a pair of opposed side walls extending from opposite sides of said rear wall, wherein said frame has a pair of opposed, inwardly directed flanges at the ends of said side walls remote from said rear wall, and said flanges have spaced holes wherein each hole is arranged to receive a fastener.

13. A load center enclosure, comprising:

a unitary plastic frame of uniform cross-section including a central base pan portion having means for mounting bus bars, circuit breakers and neutral bars thereon, a rear wall, and a pair of opposed side walls;

a pair of covers secured to opposite ends of said frame to form top and bottom walls of said enclosure;

a door assembly; and

means for securing said door assembly to said frame to form the front of said enclosure,

wherein said base pan portion is made of a first plastic and the remainder of said frame is made of a second plastic, wherein said first plastic has greater heat resistance than said second plastic.

14. The enclosure of claim 13, wherein said first plastic maintains its structural integrity up to about 265° F., and said second plastic maintains its structural integrity up to a temperature in the range of 200°-225° F.

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15. A generally U-shaped, unitary frame of uniform cross-section along its length made of a heat-resistant, non-electrically conductive plastic, comprising a central base pan portion having means for mounting bus bars, circuit breakers and neutral bars thereon, a rear wall, and a pair of opposed side walls extending from opposite sides of said rear wall,

wherein said base pan portion is made of a first plastic and the remainder of said frame is made of a second plastic, wherein said first plastic has greater heat resistance than said second plastic.

16. The frame of claim 15, wherein said first plastic maintains its structural integrity up to about 265° F., and said second plastic maintains its structural integrity up to a temperature in the range of 200°-225° F.

17. A method for fabricating an electrical load center, comprising the steps of:

extruding a heat-resistant, non-electrically conductive plastic in the shape of a frame of uniform cross-sectional shape along its length, said frame having a central base pan portion having means on a front face thereof for retaining electrical load center components thereon;

cutting the extruded plastic widthwise to form the frame;

mounting load center electrical components onto said retaining means of said frame;

mounting a pair of end caps over opposite respective ends of the frame; and

mounting a door assembly to the front of the frame.

18. The method of claim 17, the step of mounting load center electrical components including mounting bus bars, circuit breakers and neutral bars to said frame.

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United States Patent [19][11] **Patent Number:** **5,363,465** ✓**Korkowski et al.**[45] **Date of Patent:** **Nov. 8, 1994****[54] FIBER OPTIC CONNECTOR MODULE**

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[73] **Assignee:** **ADC Telecommunications, Inc.**,
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[21] **Appl. No.:** **19,615**

[22] **Filed:** **Feb. 19, 1993**

[51] **Int. Cl.⁵** **G02B 6/36**

[52] **U.S. Cl.** **385/135; 385/53**

[58] **Field of Search** **385/53, 134, 135, 139,**
385/147

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Primary Examiner—John D. Lee

Attorney, Agent, or Firm—Merchant, Gould, Smith,
Edell, Welter & Schmidt

[57] ABSTRACT

A fiber optic module which includes a framework receiving circuit card cartridges. The cartridges have a plate which extends along the sides of the housing with the first edge extending a differing length than the second edge. The module includes a housing having a framework with spaces for receiving the cartridges. The framework has slots formed therein for receiving the edges of the cartridges. The slots and spaces align the cartridges in the housing so that the cartridges are properly aligned in the housing.

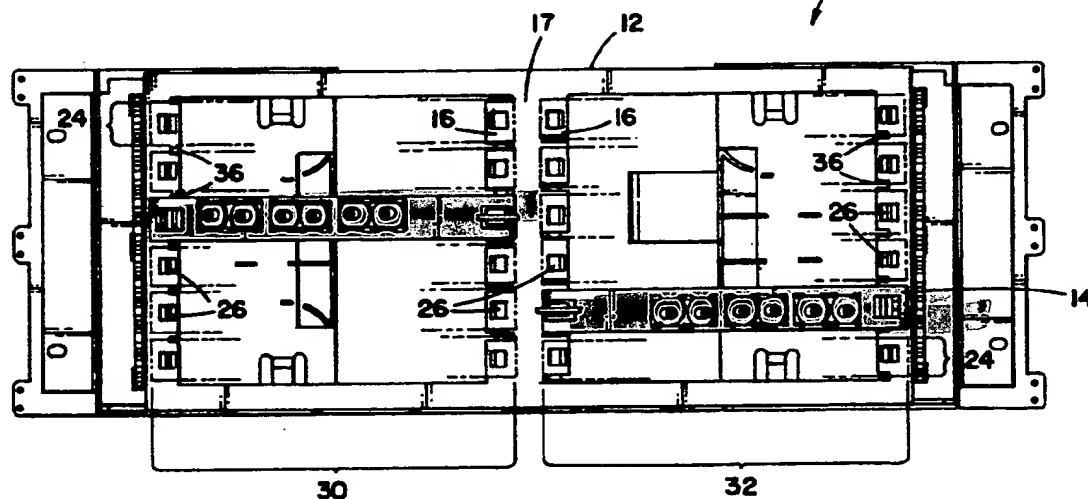
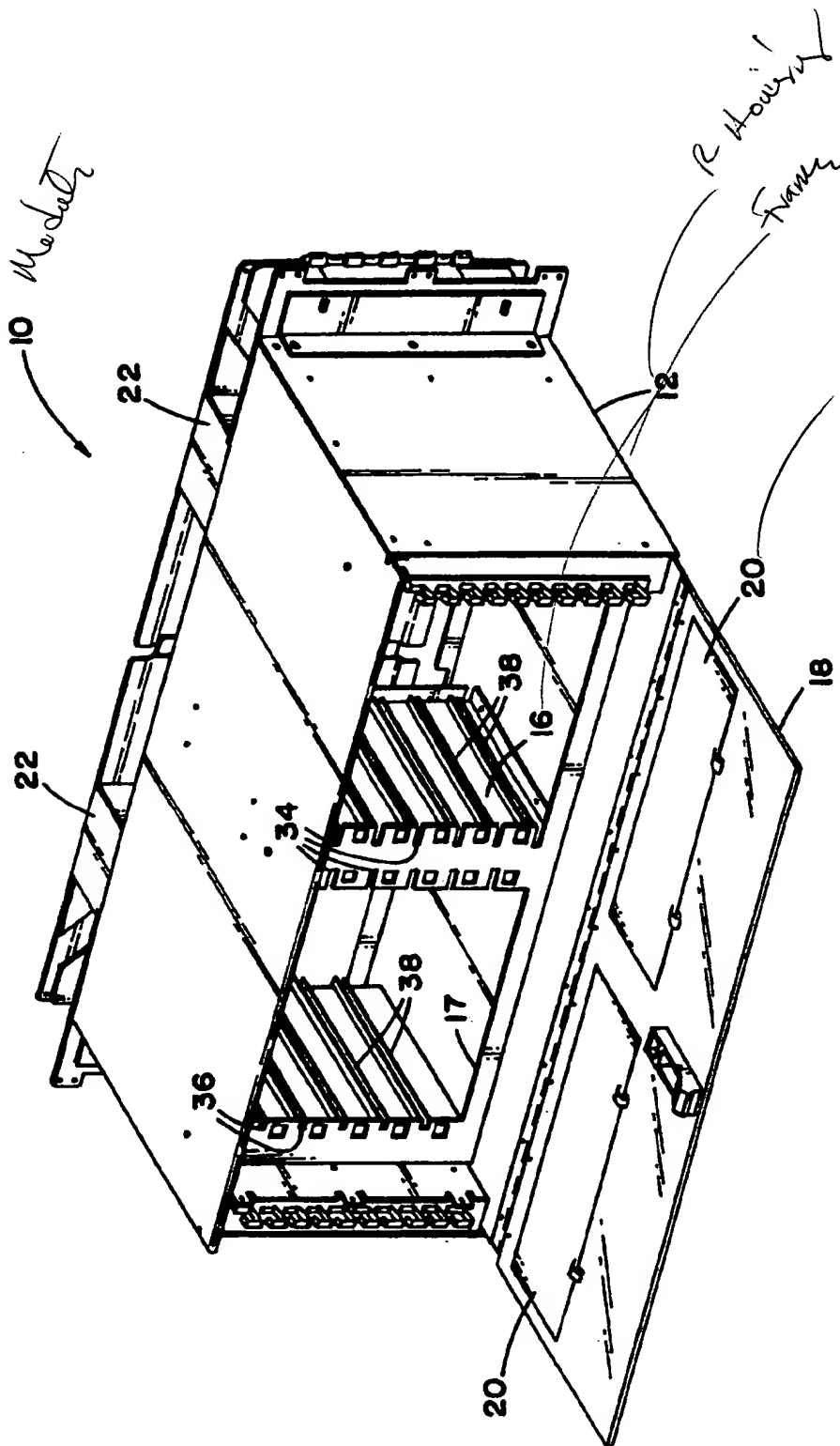
10 Claims, 5 Drawing Sheets

FIG. 1



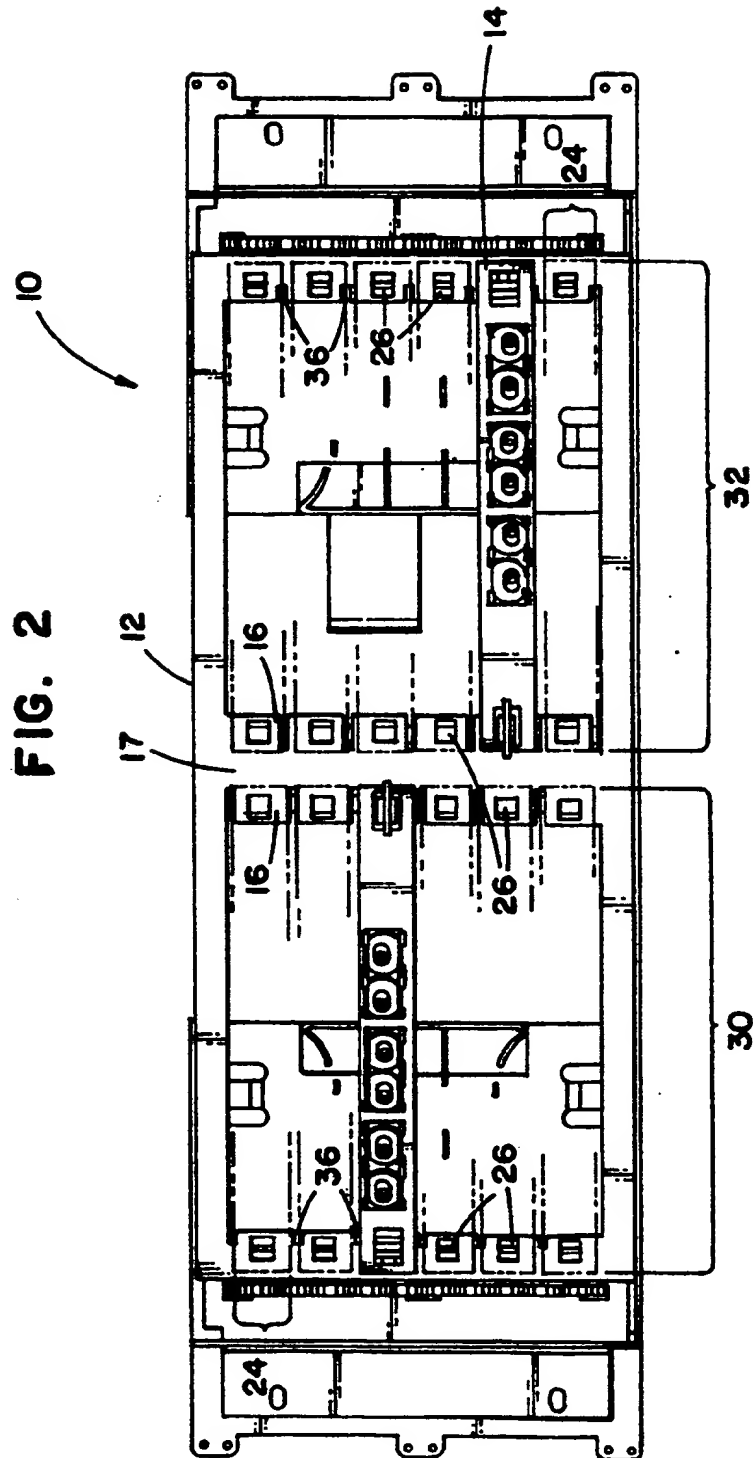


FIG. 3

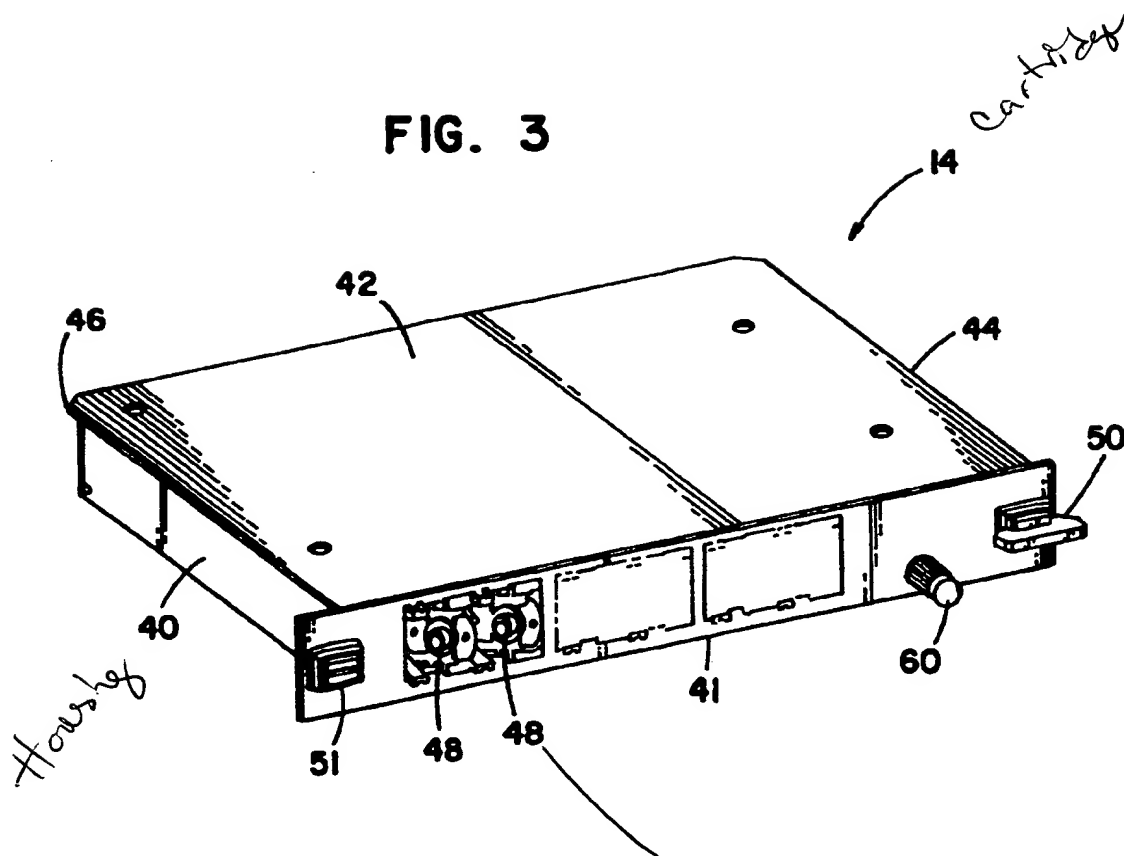


FIG. 4

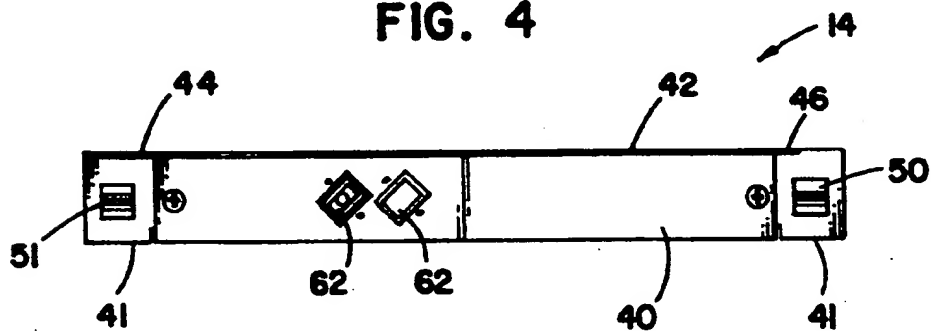


FIG. 5

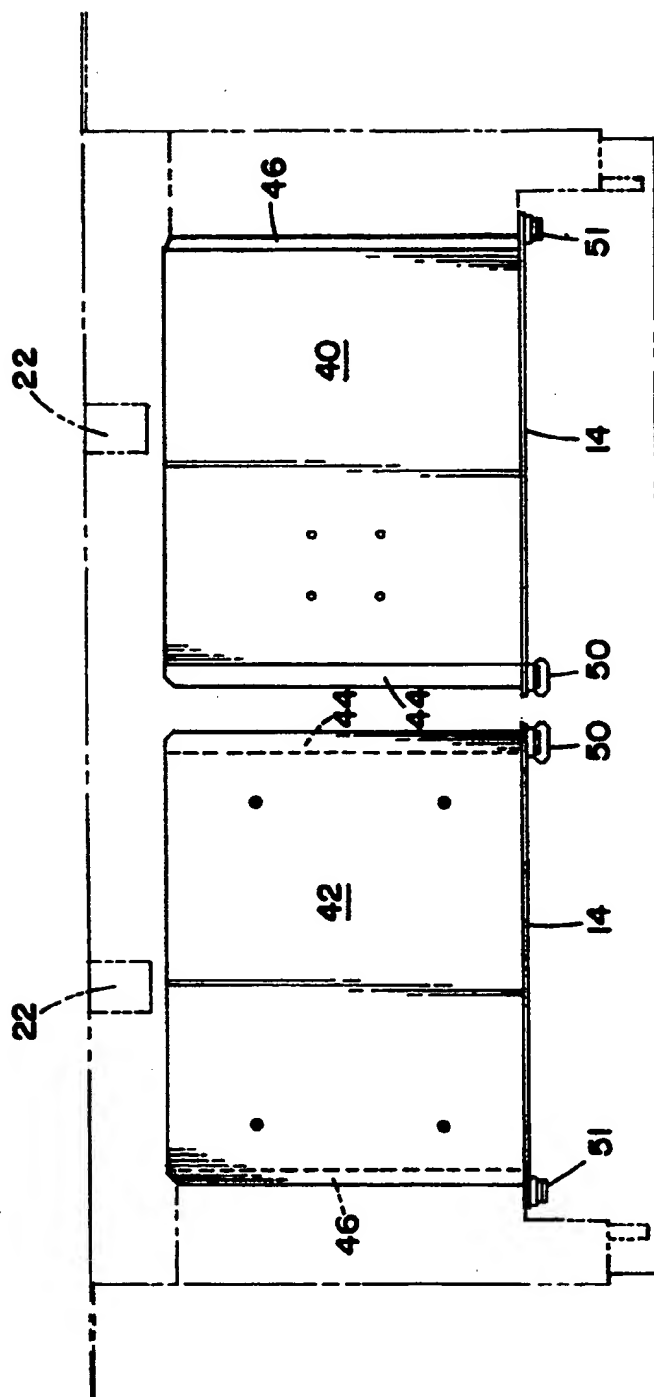


FIG. 6

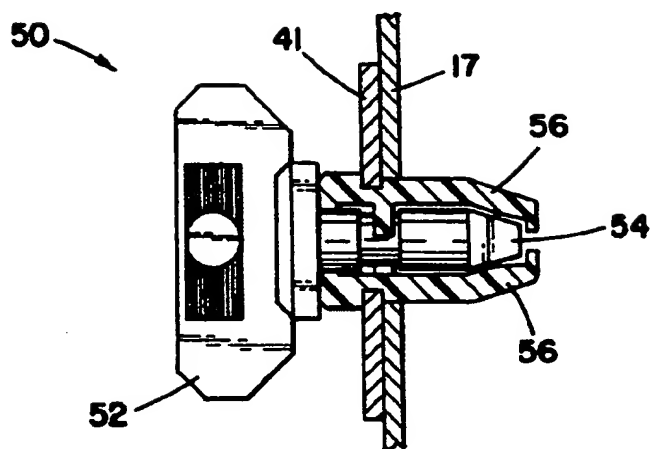
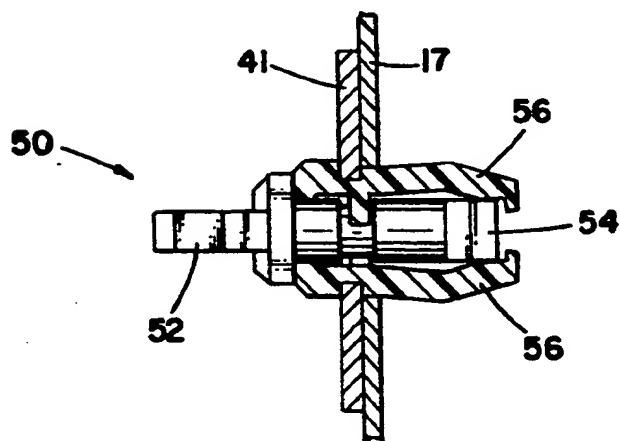


FIG. 7



FIBER OPTIC CONNECTOR MODULE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to a fiber optic connector module and in particular, to a module which accepts asymmetrical telecommunications cartridges.

2. Description of the Prior Art

Modules which accept electrical cartridges are well known in the telecommunications industry. The modules insert into a framework and make connections between cables and fibers of various pieces of telecommunications equipment.

As the complexity of the connections and the use of fiber optics increases in the telecommunications industry, wire management becomes increasingly difficult. In particular, the fiber optic cables must be routed so that the radius of curvature does not cause the cables to break or crack. In addition, the connections must be made correctly, as the high number of connections made may easily lead to errors in connecting cables and wires and malfunction of equipment. To combat this problem, connections are often made using cartridges to insert into modules, which are then attached to the framework. This aligns groups of connections and ensures proper alignment when the cartridges are correctly inserted. Even with cartridges, problems may still exist as the cartridges may be improperly inserted and incorrect connections may be made.

To ensure that cartridges are inserted into the correct slot, cartridges may be made so that they have shapes which are different from one another. Similarly, the slots in the module have shapes which have corresponding shapes. However, such a design increases the number of parts which must be stocked and leads to increased costs. This design also increase the time and complexity for insertion of the various cartridges and modules as each cartridge aligns and inserts differently.

It can be seen then, that a fiber optic module is needed which accepts cartridges which are easily insertable and which are insertable in a manner that ensures correct alignment and attachments are made. It can be appreciated that a single module which may be configured so that the direction of insertion is readily apparent and which is insertable at any slot location would decrease costs while maintaining reliability.

SUMMARY OF THE INVENTION

The present invention is directed to a fiber optic connector module and cartridges inserting into the module. The module includes a housing with a frame supporting the cartridges in the housing. The cartridges include electrical connectors for attachment to telecommunication wires and cables.

The cartridges have tab members extending from the housing which align with slots in the supporting frame. The supporting frame has orifices configured for receiving the cartridges and the tab members. The pair of tab members of each cartridge have a first length and a second length corresponding to first and second slots in the frame having a first width and a second width. The different widths of the slots ensure that the cartridge is inserted in the correct orientation into the module.

These and various other advantages and features of novelty which characterize the invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However, for a better understanding of the invention, its advantages, and the objects obtained by its use, reference should be made to the drawings which form a further part hereof, and to the accompanying descriptive matter, in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, wherein like reference letters and numerals indicate corresponding elements throughout the several views:

FIG. 1 shows a perspective view of a fiber optic connector module chassis according to the principles of the present invention;

FIG. 2 shows a front elevational view of the fiber optic connector module shown in FIG. 1 with the door removed and having cartridges inserted;

FIG. 3 shows a front perspective view of a connector module cartridge;

FIG. 4 shows a rear elevational view of the cartridge shown in FIG. 3;

FIG. 5 shows a top view of two cartridges inserted into the chassis;

FIG. 6 shows a side elevational view of a cartridge locking member in an unlocked position; and,

FIG. 7 shows a side elevational view of a cartridge locking member in a locked position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Referring now to the drawings, and in particular to FIG. 1, there is shown a fiber optic telecommunications connector module, generally designated 10. The module 10 includes a cabinet type housing 12 which receives cartridges 14 carrying circuit cards, shown in FIG. 2. The cartridges 14 are held in a supporting frame 16 and inserted into the housing 12 through a forward door 18. As shown in FIG. 1, the door 18 swings down for access to the housing 12. The door 18 includes designation cards 20 containing information on wiring and circuit cards.

In a preferred embodiment, the module 10 may include cable distribution members 22 mounted at the rear of the housing 12. The cable distribution members 22 aid in guiding wires and cables to other modules and telecommunications equipment. In the preferred embodiment, the frame 16 includes two orifices having a column 30 and 32 of spaces 24 with each column receiving six cartridges 14 in six associated spaces 24. The supporting frame 16 includes slots 34 and 36 in a forward wall 17 of the supporting frame and guiding rails 38 extending rearwardly from the forward wall 17.

As shown in FIG. 3, each cartridge 14 includes a cartridge housing 40 and an attached plate 42. The housing 40 contains circuit cards which are in electrical communication with connectors at the front and/or rear of the cartridge, as explained hereinafter. The plate 42 is affixed to one face of the cartridge housing 40 and extends over two opposing sides of the housing. The plate 42 has a first edge 44 which extends over one side of the housing 40 and a second edge 46 which extends over the opposite side. In the preferred embodiment, the first edge 44 has a greater length than the second edge 46. However, the second edge may have a greater length than the first edge 44. The edges 44 and 46 function as alignment tab members, as explained hereinafter.

In the preferred embodiment, the cartridges 14 include a number of fiber optic cable connectors 48 mountable in a forward plate 41 of the cartridges 14. The connectors 48 are angled in the preferred embodiment to aid in guiding fiber optic cables (not shown) through the module 10 so that the bending radius of the cables is not too sharp so as to cause damage to the cable. The connectors 48 snap into an opening in the forward plate and may be inserted so that the angled portion is directed to either side of the cartridge 14.

The cartridges 14 also include a pair of locking members 50 mounted at the forward plate 41. Each locking member 50 engages an associated lock orifice 26 in the forward wall 17. The lock orifices 26 are aligned on both sides of each column 30 and 32 on either side of the associated cartridge spaces 24. As shown in FIGS. 6 and 7, locking members 50 include a handle 52 which attaches to a central pin 54 having a flattened end portion which has a greater height than width. A central pin 54 engages an opposed pair of flanges 56. The flanges 56 are normally spaced so as to fit through an associated lock orifice 26 in the front wall 17. As shown in FIG. 6, when the rotatable handle of the locking member is in a first position, the pin portion 54 does not spread the flanges 56 apart. In this manner, the plate 41 can be pushed against the supporting frame 16 as the locking member flanges 56 fit through the orifices 26.

Upon rotation of the handle to the position shown in FIG. 7, the central pin 54 is rotated so that the flattened end section has its widened portion between the flanges 56. This spreads the flanges 56 outward so that the cartridge 14 is retained. In this position, the distance between the spread flanges 56 is sufficiently wide so that the locking members 50 will not fit through the orifices 26. In this manner, the cartridge 14 is secured in the supporting frame 16.

Referring again to FIG. 3, in one embodiment, the cartridge 14 will include only one complete locking member 50. The second locking member 51 includes only the spreadable flanges 56 and does not include a central pin. With this arrangement, the flanges 56 still aid to align the cartridge 14 and the flanges 56 insert into the associated lock orifice 26. The second locking member 50 still has sufficient retaining capabilities to prevent the cartridge 14 from being accidentally moved from its inserted position.

The cartridge 14 may include multiplexing capabilities on the circuit card for connecting various components of telecommunications equipment. In addition to the fiber optic cable connectors 48, the cartridge 14 may also include other telecommunications connectors 60 for attachment to various telecommunications connectors. The connections from the rear of the cartridge 14 are made with connectors 62 which may be adapted for various types of requirements, as shown in FIG. 4.

With the configuration of the frame 16 and cartridges 14, the cartridges 14 are inserted into the module 10 and are automatically aligned. The slots 34 and 36 in the frame 16 have a width which roughly corresponds to the length of the edges 44 and 46 of the cartridge plate 42. The differing lengths of the slots 34 and 36 and the corresponding plate edges 44 and 46 ensure that alignment is properly made when the cartridge 14 inserts into the supporting frame 16. Each of the slots 34, 36 has an associated guiding rail 38 which supports a corresponding edge 44 or 46.

As shown in FIG. 2, the supporting frame 16 has a row of the slots 34 on opposite sides of the columns 30

and 32. The second slots 36 are on opposite sides of the columns 30 and 32, reversed from the arrangement for the slots 34. Each column 30 or 32 has the slots 34 on one side and the slots 36 on the second side. In this manner, the edges 44 and 46 align in the slots in the first column 30 in a first orientation and align in reverse orientation in the second column 32. The cartridges 14 insert so that the plate 42 is above the housing 40 when inserted in first column 30 and below the housing 40 of the cartridge 14 when inserted in the second column 32. In this manner, the cartridges can be flipped upside down and be inserted from one column into another. The asymmetrical edge members ensure proper orientation of the cartridges 14 into the supporting frame 16. It also provides for use of a single cartridge part which can be adapted to either column 30 or 32 and which can be easily identified for proper position within the columns 30 and 32. Furthermore, the fiber optic connectors 48 angle in a direction toward the edge of the module 10 so that correct insertion direction is easier to identify.

The slots 34 and 36 are positioned relative to the locking orifices 26 so that the slots 34 and 36 are above the locking orifices in first column 30 and below the locking orifices the second column 32. This provides for universal manufacturing of the locking members so that the cartridges 14 can be inserted in either column for engagement of the locking members 50.

As shown in FIG. 5, when inserted in column 30, the plate 42 is at the top of the cartridge 14. When inserted in the second column 32, it can be seen that the cartridge 14 is inverted and the plate 42 is below the housing 40 of the cartridge 14. It can also be appreciated that when inserted, the locking member 50 and partial locking member 51 are on reversed sides of the cartridge 14 compared to the inserted position in the other column.

It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A telecommunications module, comprising:
 - a housing including an opening at a forward wall of the housing;
 - a plurality of removable cartridges containing telecommunications equipment and insertable into the housing, wherein the cartridges slide into the housing through the opening, wherein each cartridge has a first and a second side, said first side having a first cartridge guide of a first predetermined shape and said second side having a second cartridge guide of a second predetermined shape;
 - a cartridge supporting frame including a plurality of spaces for receiving the plurality of cartridges, said frame including first and second columns of said spaces, each of said first and second columns including first and second frame guides on opposite sides of said spaces, said first frame guide having a size and disposition so as to slidably mate with said first cartridge guide and said second frame guide having a size and disposition so as to slidably mate with said second cartridge guide;

said first and second frame guides disposed on first and second sides, respectively, of said spaces of said first column;

said first and second frame guides disposed on second and first sides, respectively, of said spaces of said second column whereby said cartridges are insertable into said spaces of said first column in a first orientation and insertable into said spaces of said second column in a second orientation inverted from said first orientation.

2. A telecommunications module according to claim 1, further comprising cartridge-locking members for locking the cartridges in the frame.

3. A telecommunications module according to claim 2, wherein the locking members comprise rotatable locking members, wherein the locking members lock the cartridge in a lock the cartridge in a first position and wherein rotating the locking members unlocks the cartridge.

4. A telecommunications module according to claim 1, wherein said cartridge guides are a plurality of tab members and wherein said frame guides are a plurality of slots receiving the tab members.

5. A telecommunications module according to claim 4, wherein said plurality of tab members includes first tab members having a first length and a second tab member having a second length, and wherein said plurality of slots includes slots have corresponding widths.

6. A telecommunications module according to claim 4, wherein the slots include guiding rails extending rearwardly receiving the tab members.

7. A telecommunications cartridge for inserting into a fiber optic module having a cabinet with an interior accessible through an opening and including a frame defining a first column of spaces and a second column of

spaces, a first plurality of frame guides disposed on a first side of said spaces of said first column and on a second side of said spaces of said second column, a second plurality of frame guides disposed on a second side of said spaces of said first column and on a first side of said spaces of said second column, said cartridge comprising:

a housing having a predetermined size so as to be received within any one of said spaces;

one or more telecommunications connectors mounted on said housing;

a first cartridge guide disposed on a first side of said cartridge, said first cartridge guide having a size and disposition so as to slidably mate with any one of said frame guides of said first plurality of frame guides; and

a second cartridge guide disposed on a second side of said cartridge, said second cartridge guide having a size and disposition so as to slidably mate with any one of said frame guides of said second plurality of frame guides

whereby said cartridge is slidable into any one of said spaces of said first column in a first orientation and slidable into any one of said spaces of said second column in a second orientation.

8. A cartridge according to claim 7, comprising locking members mounted on a forward end on either of said first and second sides of the housing.

9. A cartridge according to claim 8, wherein the locking members comprise spreading retaining members.

10. A cartridge according to claim 7, wherein the connectors comprise angled fiber optic connectors.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,363,465
DATED : November 8, 1994
INVENTOR(S) : Korkowski et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 5, claim 3, line 17, delete "lock the cartridge in a" after the letter "a" (first occurrence).

Signed and Sealed this
Twenty-first Day of March, 1995

Attest:



BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks